EX PARTE OR LATE FILED

RECEIVED

NOV. - 3 1993

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

DOCKET FILE COPY ORIGINAL

LAW OFFICES
GINSBURG, FELDMAN AND BRESS
CHARTERED
1250 CONNECTICUT AVENUE, N.W.
WASHINGTON, D.C. 20036
TELEPHONE (202) 637-9000

CORRESPONDENT OFFICE
9, RUE BOISSY D'ANGLAS
75008 PARIS, FRANCE

TELECOPIER (202) 637-9195
TELEX 4938614

HENRY M. RIVERA
(202) 637-9012

November 2, 1993

HAND DELIVERED

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: PR Docket No. 93-61
Automatic Vehicle Monitoring Systems

Dear Mr. Caton:

In accordance with Section 1.1200 et. seq. of the Commission's Rules, this is to advise that on Tuesday, November 2, 1993, Robert Dilworth, President of Metricom, Inc., Spencer Carlisle, Senior Research Engineer, and Roxanne Cox-Drake, Manager of the NetComm Project, Information Technologies, of Southern California Edison Company, Steve Winick, Vice President of ADEMCO, and Henry M. Rivera, Esq., Ginsburg, Feldman and Bress, Chartered, met with Chairman James Quello, Commissioner Andrew Barrett, Commissioner Ervin Duggan, and Ralph Haller, Chief of the Private Radio Bureau, as well as the following Commission staff personnel: Jeff Hoagg, Linda Oliver, Rudolfo Baca, Rosalind Allen and Steve Sharkey, to discuss the comments and reply comments filed in the above-named proceeding and to suggest solutions to the proceeding most attractive to them. The attached material, used in these presentations, was also discussed.

A copy of this Ex Parte Notice was filed with the Commission and delivered to all of the above-named Commission personnel on November 2, 1993.

Sincerely,

Henry M Rivera

Henry M. Rivera

HMR:lmc
Attachments
cc: Chairman James Quello
Commissioner Andrew Barrett
Commissioner Ervin Duggan
Mr. Ralph Haller

Research Newsletter

Vol. 19, No. 4 Southern California Edison Special Issue, 4th Quarter, 1990

NetComm Matures as Advanced Communication and Metering System

NetComm is an advanced communication system. It is based on a network of packet radios which interface with electrical distribution devices for monitoring and automation, and with customer service devices such as electronic meters. Since the NetComm project's inception in 1986, hardware and software have evolved through laboratory development and field demonstrations into today's commercial reality.

In August 1986, Southern California Edison commissioned Metricom Inc., of Campbell, California to develop and produce hardware and software for a two-way network communications system which has come to be known as NetComm. *Research Newsletter* for March 1989 (Vol. 18, No. 1) was devoted entirely to NetComm. This issue provides an update on this fast-moving and exciting project.

For many years, Edison investigated technologies for use in remote metering, as well as load management, energy conservation, and service quality improvement. Existing and emerging technologies which performed a single function tended not to offer an acceptable cost-benefit ratio. But NetComm can perform remote meter reading in addition to many other functions which fall under the category of "distribution system automation" — a concept steadily gaining interest and acceptance at Southern California Edison for improving service quality, reducing operating and maintenance costs, and improving overall distribution system efficiency. NetComm breaks economic barriers and

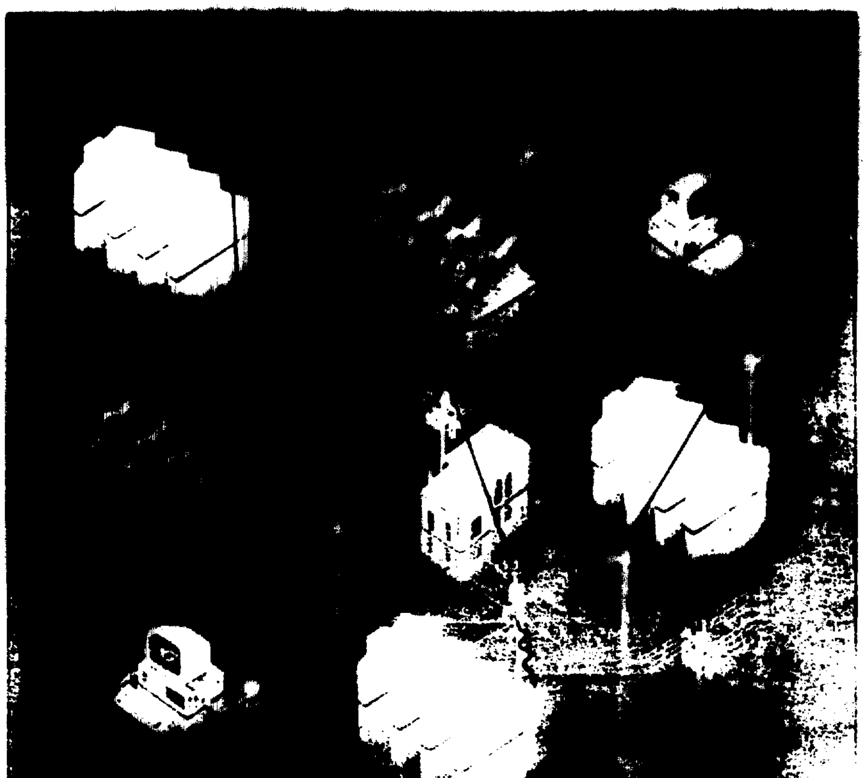


Figure 1: Radio packets can travel over many routes and through different gateways to reach their destination. A meter reading request, for example, may take the following path:

1) From one or more "head-end" computers to one or more "head-end" packet radios over hard wire;
2) From head-end packet radios to dispersed packet radios via radio waves;
3) From packet radios to meters — to solicit "reads" — over existing electrical service wires using powerline carrier; and
4) The meter readings return by reversing these steps.

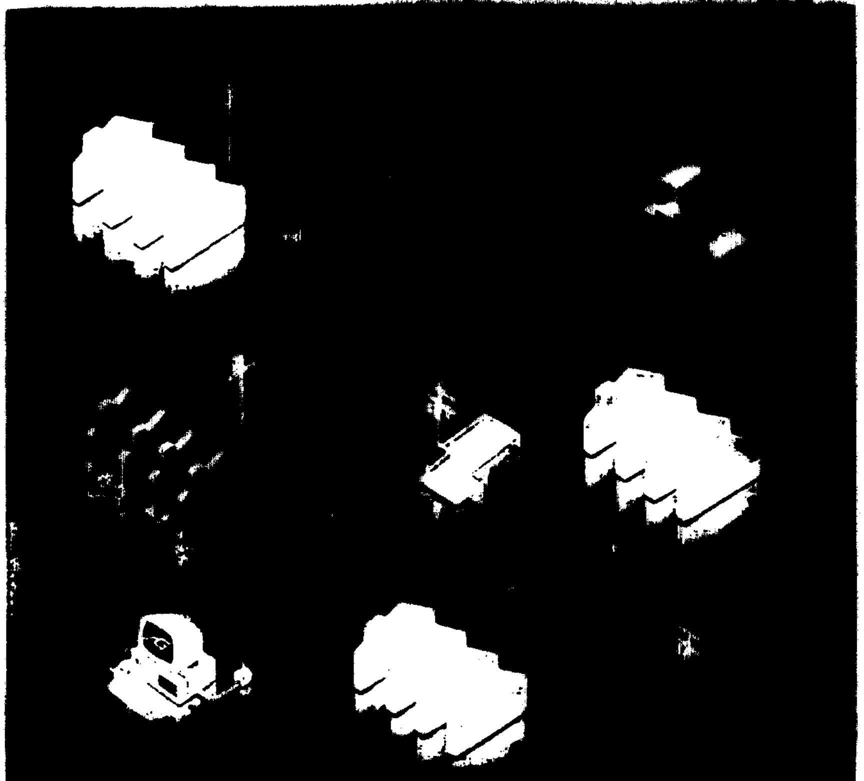


Figure 2: Timekeeping is an important design criteria for the network. Central timekeeping from one designated hub ensures that all devices, such as meters and remote terminal units, are consistent with one another, and with the utility's time, for purposes such as time-of-use billing and event recording. All devices in the network can be time-stamped with an accuracy approaching ±1 second.

provides a gateway to a new way of doing business.

Since 1986, Edison's NetComm project personnel have worked to develop a communication, metering, and control system to handle the diverse needs of the many corporate organizations which deal with the customer and with operation of the electrical distribution system.

HOW THE NETWORK COMMUNICATES

NetComm's radio network uses a technology called packet switching to establish reliability through redundancy. Rather than gamble on the dependability and perfect working order of all the elements in a single communication line, such as a telephone circuit, packet switching relies on multiple communication paths. This ensures that, if some of the paths are blocked or equipment damaged, there will be alternate routes for the message to get through.

A "packet" is a short burst of digital information which may be up to several hundred characters long. In addition to the data (e.g., a meter reading) being sent, each packet carries other information for error detection, for destination routing, and for acknowledgment of receipt. Packets can travel over a variety of media. In the NetComm system, these media are radio wave, powerline carrier, and hard wire.

The packets of information are transmitted, received, and retransmitted ("switched") by low-power radio transceivers operating in the 900 MHz band. These radios pass the packets from one to another in "bucket brigade" or "hot potato" fashion. Because the transmission power of each radio is intentionally kept as low as possible, simultaneous transmissions can take place in the same general service area with minimum interference. All radios are identical, but each has its own software-encoded geographic address.

Radios are typically installed and powered on distribution transformers' low-voltage secondaries, the same electric wires that serve customers. The radios transmit packets to and from the meters over these wires via high-frequency "powerline carrier" signals.

A radio and all the meters served by one distribution transformer form a "local area network" (LAN) as they communicate with one another over the secondaries. The radios also form a grid-like "wide-area network" (WAN) and shuttle packets via radio waves over longer distances within a specific utility service area; for example, from a central computer to an electric meter and back (Figure 1).

Each radio constantly listens for packets addressed to it, or to more distant radios for which it can act as an intermediate repeater. Although NetComm is not designed to replace high-speed data links such as fiberoptic and microwave, a data packet's transmission time between radios is less than half a second. The total turnaround time for a message to travel from its origin to its destination and back is dependent on the number of radios the packet must travel through, the message's priority, and the traffic on the system. Also, the network has the ability to maintain correct time at each of its many devices. This is important for time-based metering functions or event recording (Figure 2).

PACKET RADIOS

The packet radio now being used by Edison in its NetComm demonstrations is a commercial product and has been tested for the past year (Figure 3). This "C" packet radio received certification by the Federal Communications Commission in March 1990, and can be used anywhere in the United States without licensing. The radio software, which has been developed extensively over the past two years, is also commercial. Each radio accesses 240 channels over the 902-928 MHz band using a programmable, pseudo-random pattern. This makes the network highly immune to interference since radios will dynamically "hop" over any unusable channel in the process of transmitting the packet.

The radio-to-radio routing method has been patented, and is based solely on each radio's geographic address which is electronically implanted into the radio memory at the time it is installed. This method eliminates static "routing tables" from the operation of the network; each radio individually determines a packet's most efficient next step enroute to its final destination.

The range from radio to radio is typically three to five miles but is dependent on the terrain and other variables. In elevated line-of-sight situations, radios are reliably communicating with one another across 25 miles. Radios can be installed and powered up at a wide variety of locations which require two-way communication (Figure 4) — for instance, in remote areas or at distribution monitoring and control points.

All packet communication is essentially 100-percent error free, and has proven to be highly reliable. Of the many millions of packets transmitted during the testing, no corrupted data have been observed. All one-way communication (e.g., "switch a switch") can be verified by "return receipts."

Figure 3: NetComm packet radios and electronic meters are manufactured by Metricom, Inc. In their third generation of development, these hardware components are now commercial products. Here, in a Valencia neighborhood, a streetlight-mounted packet radio communicates with eight to ten customer meters via powerline carrier.

THE NETCOMM METER

The NetComm solid-state meter has been under development since the project's inception in 1986 (Figure 5). The meter is a software definable, microprocessor-based device. It is completely solid state and needs no mechanical adjustments. It has been designed to meet revenue metering requirements, and produce standard billing information such as real and reactive energy, demand, time of use, and interval data.

The meter also has the capability to measure, record, and profile a variety of electrical service parameters such as instantaneous or time-averaged watts, volts, amps, current, and power factor (Table 1 and Figure 6). Because the meter is able to monitor all these parameters in real time, it acts as more than a single-function billing device and becomes a distributed sensor for automation and

Figure 4: NetComm packet radios are strategically located on a variety of structures to link a far-reaching wide-area network. Location examples include streetlights, power poles and, shown here, a ground-level padmounted transformer pedestal. The flexible conduit provides the connection between the meter and the radio network.

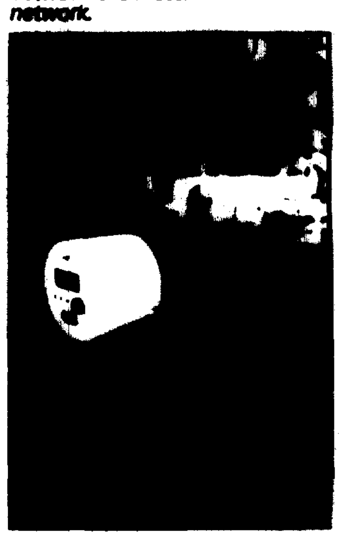


Figure 5: Manufactured by Metricom, Inc., the NetComm solid-state "C" meter features digital display, light-sensitive finger buttons for manual interrogation, and an optical infrared port for on-site meter reading or programming with hand-held computer. Powerline carrier communication is through stabs at the base of the meter.

load-management functions. These capabilities will be helpful to the utility (and the customer) in monitoring energy and power usage, and in evaluating service-related problems.

Most meters presently installed in Edison's NetComm demonstrations are pre-commercial prototype "B" meters, suitable for residential installations. The commercial, or "C" meter, is being tested by Edison's Shop Services and Instrumentation Division, and will soon be available in single or polyphase.

CUSTOMER COMMUNICATIONS

One of the many functions that NetComm makes possible is two-way communication between a customer, or their programmable appliances, and a utility. At hours of peak electrical demand, the utility may wish to ask customers to limit nonessential appliance usage. NetComm can do this through a broadcast signal (Figure 7), allowing customers and appliances to respond rapidly, thus limiting demand and avoiding the kind of stress on electrical power supply that can lead to brownouts. (Southern California presently has sufficient generating capacity, but in other parts of the country demand is approaching generation limits and this NetComm feature is highly valued.) This demand-reduction technique is part of the concept known as load management, and programmable appliances are crucial to its success.

Examples of energy-saving programmable appliances include refrigerators that defrost at night; dishwashers, clothes washers and dryers that operate off-peak; and cool storage units that create ice during off-peak hours, then circulate coolness during midday hours when conventional air conditioners are placing high demands on the generation system.

The NetComm meter and programmable appliances are the building blocks of home automation, and similar strategies can be developed for industrial and commercial customers. Utilities can reward customers who defer their nonessential electricity use through time-of-use rate incentives. Such strategies for leveling load mean that existing power plants run more efficiently and that additional plant construction can be deferred.

Several equipment suppliers have expressed interest in interfacing their load-control devices with NetComm. The local-area network protocol has been licensed to them and some prototypes have already been developed. Metricom has developed a load-control transponder to operate water heaters, pool pumps, space heaters, air conditioners, and other household appliances. Like the meter, this unit communicates with a packet radio via powerline carrier.

Work continues on the development of interfaces with meters, controllers, and other devices which can communicate remotely over the NetComm system. For instance, field testing is presently under way on a remote terminal unit (RTU) for monitoring and controlling capacitor bank

Table 1: Capabilities of the NetComm solid-state "C" meter.

WHAT THE "C" METER CAN DO
Single-Phase (Residential)
or Three-Phase (Commercial/Industrial)

Electricity Consumption — Totals and per Phase
- Kilowatt-hours (forward and reverse)
- Kilovar-hours (lead and lag)

Average, Instantaneous and Maximum/Minimum
- Voltage
- Power
- Vars
- Volt-Amperes
- Current
- Power Factor

Additional Functions
- Up to Ten Simultaneous Profiles of Electrical Quantities
- Time-of-Use (TOU) Metering
- Demand and Cumulative Demand
- Outage Information
- Emulation of Other Manufacturers' Meter Functions and Protocols
- Self Diagnostics
- Meter Temperature

switches, automatic reclosers, line switches, and other devices which will enhance NetComm's ability to perform distribution automation functions.

DISTRIBUTION AUTOMATION

Electrical power goes through three basic stages before it reaches a utility customer. Power plants generate power; high-voltage power lines and substations transmit that power; and smaller substations, circuits, and other apparatus distribute the power to the ultimate customers. Edison's distribution system includes about 4,000 circuits, over 600,000 transformers, more than 11,000 capacitors, and tens of thousands of distribution switches, fuses, and substation circuit breakers. This equipment is routinely maintained to provide reliable service to customers, although continuous monitoring and control of thousands of circuits, transformers, and capacitors is not cost effective today.

NetComm can change all that. Specially designed sensors, switches, and monitors will keep the distribution grid accountable to central control areas through the packet radio network. These distributed devices can process monitoring and control functions such as line fault location and clearing, line sectionalizing, capacitor bank switching, and distribution feeder monitoring (see Figure 8).

NetComm provides the communication means to remotely interrogate the distribution system in order to identify the location and extent of an outage, and to remotely control line devices that can restore service to a majority of customers faster. With distribution automation, Edison can significantly reduce the number and length of customer service interruptions, improve power quality and service reliability, more efficiently plan its distribution system, and reduce field operating costs. Many analysts believe that distribution automation will offer the key economic benefits

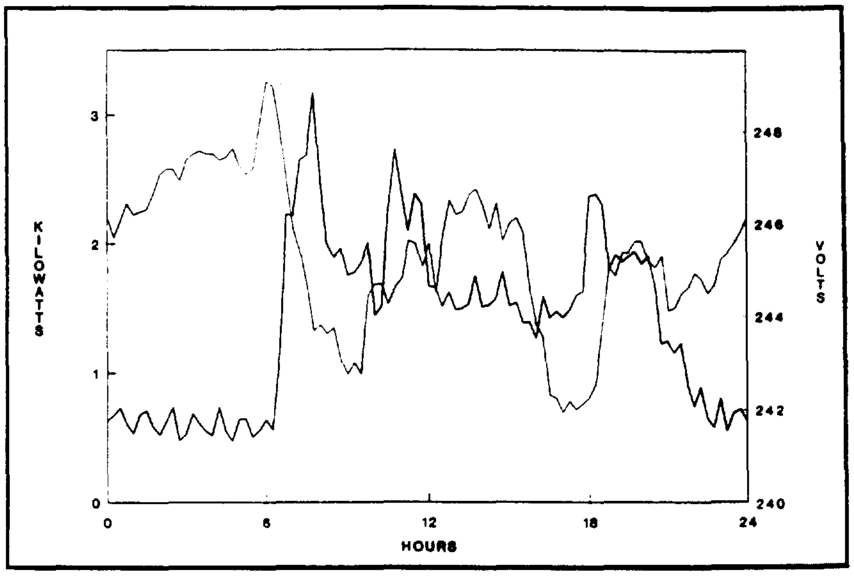


Figure 6: This graph shows an actual power and voltage profile from a residential Edison customer. Power (watts), in black, shows actual electrical load. Voltage, in blue, shows an approximate inverse relationship with electrical load. These are just two of the many parameters that the NetComm meter can measure.

Figure 7: Another use for the network is in a "broadcast" mode for sending commands or other information to a large number of end points — for instance, to initiate load control or send energy price information. The broadcast mode protocol can reach thousands of devices in minutes, and allows complete verification of the message getting to its destination.

Figure 8: NetComm permits automation of some functions of the utility distribution network. Here, personnel from a substation, district office, or other location use the packet radio network to remotely monitor and/or control the equipment that distributes electricity to customers. This communication task can be similarly performed by a field crew in a mobile unit.

Figure 9: There are 20 NetComm meters installed on Edison-sponsored Houses-of-the-Future in the Riverside and San Bernardino areas. These meters check load profiles and load factors in homes with automation systems linked to advanced appliances.

of NetComm and some of the most tangible benefits to customers. (See ***Research Newsletter***, Vol. 19, No. 3, "Automating Distribution through NetComm.")

SYSTEM DEMONSTRATIONS

Edison has installed, and is operating, communication/ metering networks in four different service areas. These are the San Bernardino/Riverside area (Figure 9), Valencia (Figure 10), Ventura (Figure 11), and in Monrovia District through the Foothill Project (Figures 12 and 13). In total, there is NetComm radio coverage over approximately 300 square miles.

FUTURE NETCOMM PLANS

One advantage of the NetComm communication technology is that it is modular and very easily expanded. Thus, networks installed in one area for certain functions can be readily linked to other networks in adjoining areas which may be installed in the future. As equipment costs decline with volume production and integration, more applications can be added until the entire service area is covered.

An electric utility may be the perfect candidate for a flexible, far-reaching system like NetComm because a utility has so many potential service uses. Thus far, Edison has identified approximately 25 specific applications for NetComm technology which are believed to be commercially viable now. Selection of these applications has been based on Research's commercialization plan for NetComm, which calls for identifying ***niche markets*** within the Company in which to deploy the technology.

Some demonstrations scheduled for the near future include:

- Stand-alone polyphase NetComm meters for all new commercial and industrial customers;
- NetComm metering for some remote areas;
- NetComm metering for high-security areas, such as gated

communities, and for high-crime areas;
- Remote monitoring of distribution circuit automatic reclosers;
- Monitoring the status of distribution circuit apparatus for remote volt/var control; and
- NetComm metering for load research.

OTHER UTILITIES INVOLVED

Other utilities are starting to implement NetComm technology. A "users group" with these participants is presently meeting every six months to disseminate information and exchange ideas. Along with Southern California Edison, participating utilities are Pacific Gas and Electric (PG&E), Boston Edison, Florida Power and Light (FP&L), Iowa Public Service Company, and Public Service Electric & Gas Company (PSE&G) in New Jersey.

PG&E has installed a NetComm system in Vacaville, California. Primarily, they have been testing remote meter reading over approximately 150 square miles. Metricom meters are being used directly for billing purposes and are being read by meter readers as well as remotely over the network. PG&E is also investigating use of the system for telemetering (transmitting data from weather stations, for instance) and gas metering.

Boston Edison has two test programs under way. One is a remote meter reading demonstration in Newton, Massachusetts, in an old overhead area where meter reading is difficult. The other test site is in the City of Boston on its aged underground network. For this test, packet radios are being mounted in underground vaults for powerline connection to the secondaries, with radio antennae installed in ground-level vault covers.

Florida Power & Light is installing a network in a suburb of Miami. Their primary interest is in controlling electric water heating and air conditioning loads during peak demand periods.

Figure 10: The Valencia network has actually been operating for the past three years and is the largest NetComm demonstration, consisting of approximately 1,000 meters and 220 packet radios. The demonstration obtains network performance statistics, and tests "batch" meter reading as well as new, user-friendly head-end computer software.

Iowa Public Service is installing a complete Metricom system in a small town where all customers will be connected to the network for the purpose of energy-efficiency testing.

PSE&G is primarily interested in the distribution automation capabilities of the NetComm system.

Figure 11: The Ventura demonstration is small — just 40 meters and 15 packet radios. NetComm meters measure coincidence loading from all customers connected to one distribution transformer. Normally the measurements are read remotely; this lap-top computer is being used to perform a field check.

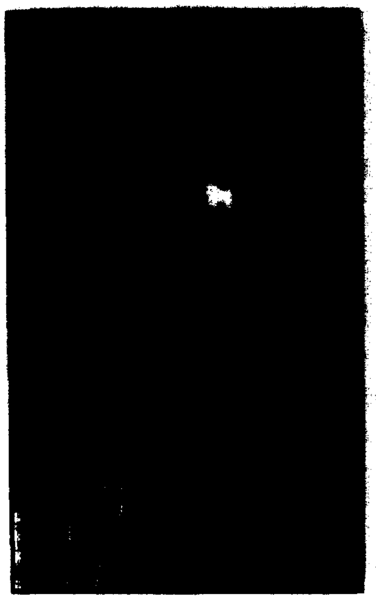


Figure 12: Approximately 100 meters and 120 packet radios have been installed in the Monrovia area as part of the Foothill Automation Project. Meters are being used for remote circuit voltage monitoring. Packet radios, like the one shown here on the streetlight, are being interfaced with capacitor switches and automatic reclosers to monitor and control these devices from a central point. Other devices, such as remote terminal units (RTUs), are being interfaced to the radios to perform various distribution automation functions.

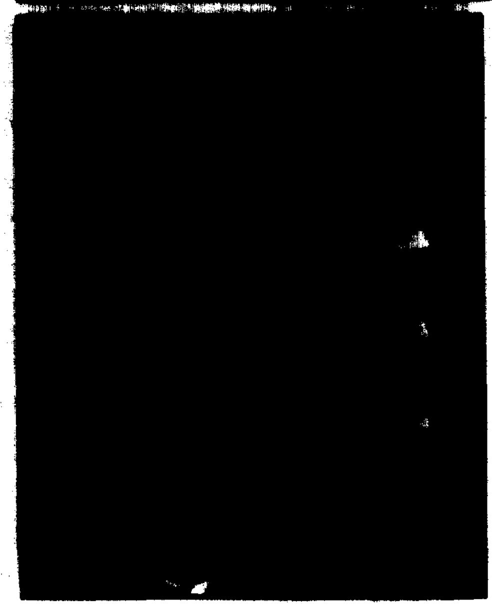


Figure 13: These four packet radios, mounted on an Edison communication tower, comprise a "head-end radio" — one of two central communication links for the Foothill Automation Project.

NETCOMM COMES OF AGE

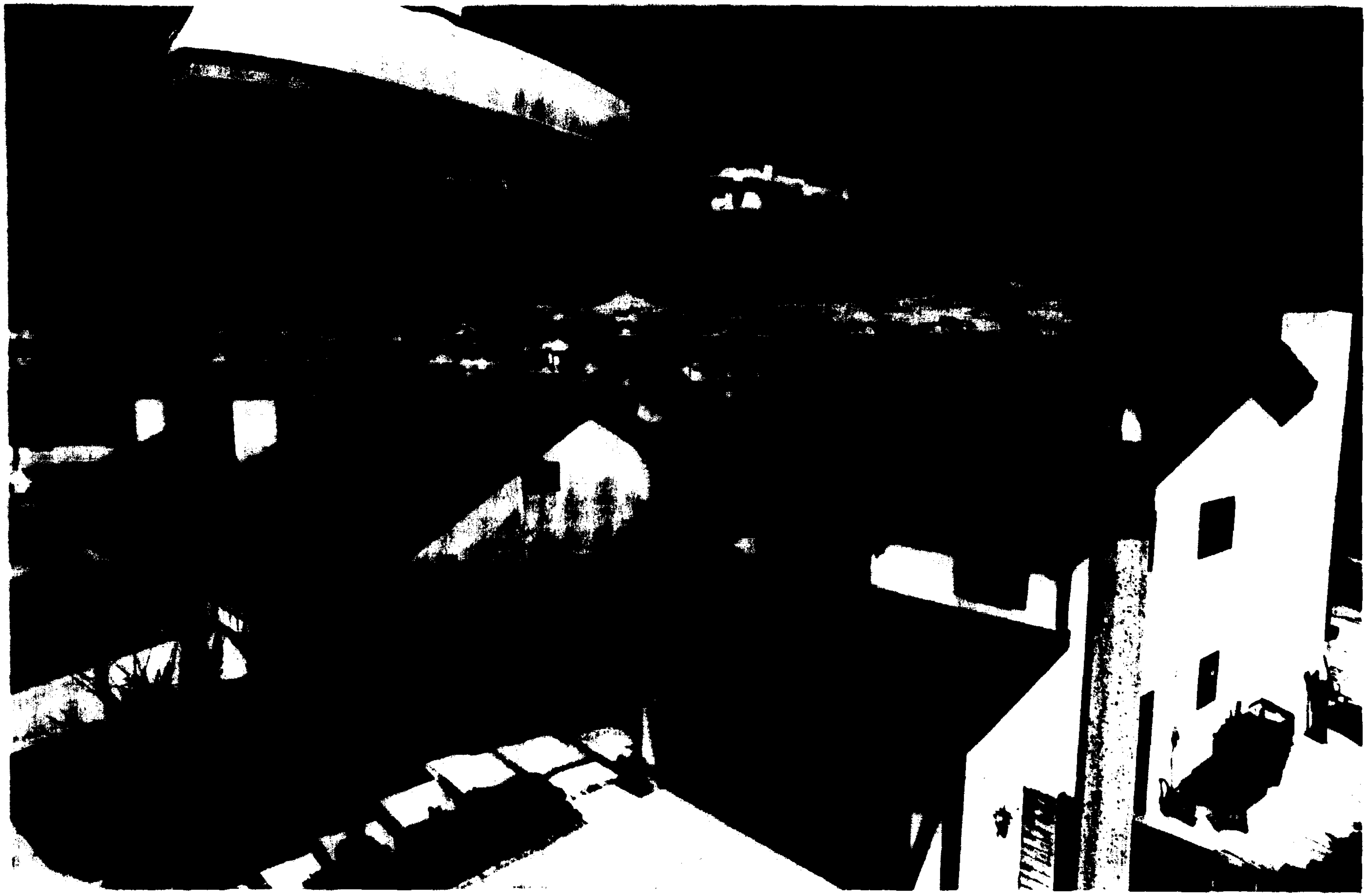
Edison is highly encouraged by the progress in the NetComm system's development. All of the original objectives set forth in 1986 have been met and systems are now being installed for commercial use. The fact that packet radio communication has many more applications than those originally used to justify the research project has been amply proven. The number of applications for the system seems to grow with the number of utility users who become familiar with the technology and its capabilities. As high-volume manufacturing commences, and hardware costs are lowered, NetComm will quickly spread beyond the realms of research and into daily use.

Figure 14: NetComm personnel, l. to r., first row: Spencer Carlisle, Doug Whyte; second row: Bob Yinger, Bob Soutner, Paul Skvarna; third row: Larry Hawkins, Ed Parhams, Jim Horstman, Connie Gimbel, Harry Hour. Absent: Florence Glazebrook.

Southern California Edison Company
P. O. Box 800
Rosemead, CA 91770

Editor: F. P. Sioshansi
Technical Writer: M. K. Fitzpatrick
Coordinator: C. Barrows

Research Newsletter is produced by the Research Division of Southern California Edison Company. Single copies are available upon request. Please address all inquiries to:
Editor, Research Newsletter
Room 449
Southern California Edison
P. O. Box 800
Rosemead, CA 91770



NETCOMM FIELD TESTS – NetComm, Edison's new Network Communication system, is currently linking more than 1000 Edison Valencia-area customers' new all-electronic meters to the utility's computers via a communications network of high-frequency packet switching radios located atop street lights.

Southern California Edison